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POLYCARBONATE DOUBLE WALLED LIQUID HOLDING VESSEL

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FIELD OF THE INVENTION

The present invention relates to double walled plastic vessels for holding and/or storing liquids. More specifically, the present invention relates to such vessels that are formed of a durable, substantially transparent material.

BACKGROUND OF THE INVENTION

The prior art includes various double-walled plastic vessels, both resealable and non-resealable. Resealable examples include thermoses and like containers. Non-resealable examples include various double-walled tea and coffee cups (i.e., tumblers) and related items.

The prior art also includes transparent liquid holding vessels. These include a wide range of containers often formed of any of the standard commercial plastics. Examples include clear plastic soda and fruit juice bottles, soup and other liquid containers, and water bottles. Polyethylene terephthalate is an example of a plastic used to fabricate single use water bottles.

Higher end water bottles and like devices are known that are made of a polycarbonate resin sheet material. Polycarbonate is favored in some applications because it exhibits resistance to odors and flavors and thus different tasting beverages can be placed in a container with less likelihood of a taste "memory" from the previous beverage. Polycarbonate resin sheet material is also

relatively durable compared to many conventional beverage container plastics. One commercial source of polycarbonate is General Electric which sells this material under the trade name "Lexan." Nalgene is one maker of water bottles and laboratory equipment that are made of single walled polycarbonate.

Notwithstanding the benefits of polycarbonate, it is disadvantageous, among other reasons, in that it is relatively difficult to work with. It tends to be more viscous and rigid than other plastics and joining two components made of polycarbonate typically requires a weld that is unsightly.

Furthermore, relative to other types of beverage container plastic, the polycarbonate raw material is expensive. Coupling the material cost with the elevated cost of manufacture (associated with the difficulty in working with polycarbonate) renders polycarbonate products disadvantageously expensive.

Accordingly, due to problems associated with cost of material, difficulty in manufacturing, joining components and/or hiding unsightly joints, etc., prior art vessels using polycarbonate have been limited to single wall vessels or double walled vessels with only a single wall of polycarbonate material. The benefits of having a double walled polycarbonate vessel, for example, durability, insulating, transparent, non-odor absorbing, potentially microwave-able, etc., are not realized.

A need thus exists for a double walled polycarbonate liquid holding vessel that overcomes the deficiencies of the prior art and achieves some or all of the above stated benefits. A need further exists for a double walled polycarbonate liquid holding vessel that is resealable and at least in part transparent.

SUMMARY OF THE INVENTION

The present invention may be realized in several different embodiments and is not limited to the specific embodiments illustrated herein.

In one embodiment, the present invention includes a inner wall and an outer wall that are both formed of polycarbonate material. These walls are separated at least in part by an insulative gap. The inner and outer walls may be coupled to a resealable unit that may include a base and resealable lid or other resealable element. The inner and outer walls may couple directly to this unit.

The inner and/or outer wall may be formed of transparent polycarbonate to permit inspection of contents behind the wall. If both the inner and outer wall are transparent, then the contents of the vessel are visible. A transparent outer wall permits inspection of printing or aesthetic patterning on the exterior surface of the inner wall or on an insert provided between the inner and outer walls.

The outer wall can be multi-part to permit more aesthetic shaping of the vessel, including a taper towards the top or another shape, and/or the inclusion of other members that provide an desired aesthetic feature or provide a different printable surface or other marking or the like.

Beneficial features on the present invention include that the resultant vessel is durable (and resists scratches), insulative, non-metallic (i.e., potentially microwave-able), non-odor absorbing and may be configured to provide an outwardly disposed printable surface or surfaces, among others beneficial features.

The attainment of the foregoing and related advantages and features of the present invention should be more readily apparent to those skilled in the art, after review of the following more detailed description of the invention taken together with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-sectional side view of a polycarbonate double walled liquid holding vessel in accordance with the present invention.

Figs. 2A-2D are a series of perspective views that illustrate one method of manufacturing the polycarbonate double walled liquid holding vessel of Fig. 1.

Fig. 3 is a side elevation view of the polycarbonate double walled liquid holding vessel of Fig. 1.

Figs. 4-7 are cross-sectional views (in whole or part) of other embodiments of a polycarbonate double walled liquid holding vessel in accordance with the present invention.

DETAILED DESCRIPTION

Referring to Fig. 1, a cross sectional side view of a polycarbonate double walled liquid holding vessel in accordance with the present invention is shown. From a top plan view, vessel 10 may be substantially round, though it should be recognized that vessel 10 may have any shape in top plan view, e.g., square, rectangular, polygonal, elliptical, amorphous or any other shape, without departing from the present invention.

Vessel 10 may include an inner wall 12 and an outer wall 14. These walls 12,14 are preferably separated at least in part by a gap 15 that provides an insulative function. Gap 15 may contain only air or another

substances such as foam, or any gaseous, liquid or solid material. Inner wall 12 and outer wall 14 are preferably sealed in an air-tight manner such that gap 15 is air-tight. Both inner wall 12 and outer wall 14 may respectively include bottoms 16,17 which may be formed integrally or otherwise. The bottoms 16,17 may be inter-coupled or spaced in a manner that maintains a continuous gap therebetween. Inter-coupling may be achieved through a variety of mounting structures including a ring 19 (shown in phantom lines) mounted to each bottom, or a plurality of "leg" members or an "X" or other geometrically shaped structure (from a top perspective), etc. The inter-coupling member(s) 19 serve(s) to provide enhanced stability to the double walled arrangement of device 10 (or the other devices herein, in addition to the welds ending in "60" discussed below).

Inner wall 12 is preferably formed of a polycarbonate resin sheet material such as Lexan or another suitable polycarbonate or polycarbonate-like material. The polycarbonate may be transparent (such that it can be readily seen through), translucent or partially to fully opaque. It is preferably transparent to permit visual inspection of the contents within, though it may be formed otherwise to achieve a desired appearance or function (e.g., reflective to reduce solar heating or dark to facilitate same, etc.). Outer wall 14 may also be formed of a polycarbonate resin sheet material or the like with the same or similar characteristics to those of inner wall 12. The provision of a transparent polycarbonate material for the inner and outer walls permits visual inspection of the contents of vessel 10.

Inner wall 12 and outer wall 14 are preferably attached to a resealable unit 30 that permits resealable

access to cavity 40 inside inner wall 12. Unit 30 may include a base 32 having an annular member 34 and a threaded neck 35 (or another suitable arrangement). A cap 36 may be threaded onto neck 35. Note that while cap 36 is preferably threaded it may be resealable joined by other mechanisms including, but not limited to, snap-on, slide-on, a clamp, etc. Cap 36 may be moveably tethered to vessel 10 by leash 38. Cap tethering arrangements are known in the art.

The inner and outer walls 12,14 are preferably coupled to base 32 of resealable unit 30, though they may be otherwise coupled. Inner wall 12 is preferably formed integrally with base 32. Known fabrication techniques for integral formation of these components, including an air-blow based fabrication of inner wall 12, are generally known in the art.

Outer wall 14 is also coupled to resealable unit 30. This may be achieved by coupling outer wall 14 to base 32 via a weld 60. This weld is preferably formed by a sonic weld. Sonic welding is known in the art. Other joining techniques, however, may be used and these include, but are not limited to, glue, compression, threading (for example, a threaded outer wall could be removed for cleaning), etc. The upper region or collar 13 of outer wall 14 (and of inner wall 12) may be indented, particularly relative to base 32, such that the typically unsightly weld 60 is substantially hidden underneath the base.

Outer wall 14 may also include a second weld. In the embodiment of Fig. 1, outer wall 14 may be formed of two sections 54,56. The provision of two or more sections provides more opportunity for modifying the aesthetic features (shape, appearance, etc.) of the vessel. The

provision of two or more sections can also be done in a manner that permits the inclusion of other surfaces or substrates, for example, to enhance function, aesthetics or to otherwise mark or distinguish the vessel.

In the embodiment of Fig. 1, sections 54,56 are each approximately one-half of the height of the outer wall, but could be otherwise arranged. The sections 54,56 are preferably welded together at weld 62 which may be a sonic weld as discussed above for weld 60. A bottom portion 59A of top section 54 and a top portion 59B of bottom section 56 may be indented proximate second weld 62 to accommodate a band 58. Band 58 may provide one or more of the following functions. It may hide weld 62, be made of a material that facilitates a better grip by a user, be an additional substrate for printing or engraving, provide a desired aesthetic feature, support a logo or other type of commercial or personal marking, etc.

Gap 15 between the inner and outer walls may be continuous or discontinuous. A continuous gap is one that is substantially free of members or other structures that connect the inner wall to the outer wall. While these members enhance structural integrity, they may conduct cold (or heat) away from the inner wall towards the outer wall and hence compromise the thermal insulative properties of the vessel. Gap 15 is preferably continuous, but may be made otherwise without departing from the present invention.

Referring to Figs. 2A-2D, a series of perspective views that illustrate aspects of manufacturing a polycarbonate double walled vessel in accordance with the present invention are shown. Fig. 2A illustrates inner wall 12 with base 32 formed integrally therewith. Fig. 2B illustrates top section 54 which is slid over the

configuration of Fig. 2A and welded to the underside of base 32 (at weld 60 of Fig. 1). Bottom section 56, shown in Fig. 2C, is then slid over the remainder of inner wall 12 and welded to top section 54 (at weld 62 of Fig. 1). Band 58, shown in Fig. 2D, is then positioned into complementary recess 59 (formed in part in top section 54 and bottom section 56) to hide weld 62, among other potential reasons. Band 58 may include a design feature 57 such as an oval or other shaped section or substrate for printing on or for mounting/displaying an item (logo, etc.) or as otherwise alluded to herein. Band 58 may be made in whole or in part of an elastomeric material such as rubber or a rubber like material and is preferably stretched over bottom section 56 until it settles into recess 59, or can be otherwise constructed. Note that the supplemental surface member that is band 58 need not be elastomeric, may be mounted by glue, welding or other mounting means and may be differently shaped, etc.

Referring to Fig. 3, a side elevation view of vessel 10 of Fig. 1 in accordance with the present invention is shown. Fig. 3 illustrates cap 36, base 32, leach 38, top section 54 and bottom section 56 (of outer wall 14), band 58 and design feature 57.

Referring to Fig. 4, a cross sectional side view of another polycarbonate double walled liquid holding vessel 110 in accordance with the present invention is shown. Vessel 110 is similar to vessel 10 of Fig. 1 (for example, inner wall 112 is preferably formed in the same manner as inner wall 12), yet the outer wall 114 includes a top section 154 that is relatively large compared to the bottom section 156, resulting in a weld 162 or other joint that is located towards the bottom of the vessel. While the top and bottom sections 154,156 could be configured to

define a recess such as recess 59 of vessel 10 (to accommodate band 58), weld 162 may be sufficiently near the bottom of the vessel that a bottom piece 170, perhaps made of non-slip rubber or the like, can be provided in such a manner as to hide weld 162 and/or provide any of the other functions of band 58. The inner and outer walls 112,114 in this embodiment, between base 132 and bottom piece 170, may be uninterrupted, providing a continuous substrate for clear viewing or patterning, etc.

Referring to Fig. 5, a cross sectional side view of another polycarbonate double walled liquid holding vessel 210 in accordance with the present invention is shown. Vessel 210 may share many of the same features and components of vessel 10 of Fig. 1, for example, inner wall 212 may be formed in the same manner as inner wall 12 of Fig 1. One difference is that the outer wall 214 of vessel 210 is preferably made of a singular piece of polycarbonate material as opposed to two sections (top and bottom sections 54,56) as in vessel 10. The singular piece outer wall 214, which is free of a weld such as weld 62, may present a smooth, unobstructed outward surface. Outer wall 214 is preferably mounted to vessel 210 by welding the top of outer wall 214 to base 232. A sonic weld such as weld 60 or other suitable joining means may be used. The embodiment of Fig. 5 potentially provides a double walled vessel with an unobstructed outer and inner wall 214,212.

Referring to Fig. 6, a cross-sectional side view of a portion of a double walled vessel liquid holding vessel 310 in accordance with the present invention is shown. Fig. 6 illustrates the upper portion of a vessel 310 in which the arrangement of base 332 and inner and outer walls 312, 314 is different from that of Fig. 1. Inner

wall 312 has a more pronounced taper (than wall 12) and base 332 extends outward from a part near the end of the taper.

Outer wall 314 is joined to the underside of base 332, preferably by welding at 360 (like weld 60). Relatively, weld 360 is farther out on base 332 than weld 60 on base 32.

Referring to Fig. 7, a cross sectional side view of another polycarbonate double walled liquid holding vessel 410 in accordance with the present invention is shown. Vessel 410 may include an inner wall 412 and outer wall 414. The outer wall may be formed in two sections: a top section 454 and a bottom section 456. In contrast to the embodiment of Fig. 1, and other embodiments herein, the diameter of inner wall 412 towards a middle and lower region thereof is wider than the diameter of the outer wall 414 towards a top portion thereof. The configuration of vessel 410 may be achieve by fitting top section 454 over the top of the inner wall (in contrast to sliding it up from the bottom as was the preferred mounting method in the embodiments of Figs. 1-6) and sliding bottom section 456 up from the bottom.

Top section 454 may be joined to inner wall 412 at weld 460 (which may be a sonic or other type of weld) and bottom section 456 may be joined to top section 454 at weld 462. Welds 460 and 462 may be sonic or another type of weld. The top and bottom sections 454,456 may be joined other than be welding.

While the invention has been described in connection with specific embodiments thereof, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the

principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth, and as fall within the scope of the invention and the limits of the appended claims.